



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/716,785	11/19/2003	Wu-Song Huang	FIS920030377US1	6138

32074 7590 07/18/2006

INTERNATIONAL BUSINESS MACHINES CORPORATION  
DEPT. 18G  
BLDG. 300-482  
2070 ROUTE 52  
HOPEWELL JUNCTION, NY 12533

EXAMINER
----------

LEE, SIN J

ART UNIT	PAPER NUMBER
----------	--------------

1752

DATE MAILED: 07/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/716,785

Applicant(s)

HUANG ET AL.

Examiner

Sin J. Lee

Art Unit

1752

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,2,5,7-16,19 and 21-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,5,7-16,19 and 21-30 is/are rejected.
- 7) ☒ Claim(s) 12,13,25 and 26 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/28/06.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### **DETAILED ACTION**

1. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

### ***Claim Objections***

2. Claims 12, 13, 25 and 26 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Applicants amended present claims 1 and 14 such that the pendant solubility-promoting moiety (which can only be a fluoroalcohol, a carboxylic acid, an amino group, an imino group, a fluorinated imino group or a fluorinated amino group) is protected with the cyclic ketal acid labile moiety. In those claims 12, 13, 25 and 26, the solubility-

promoting group *which is not protected with the cyclic ketal acid labile moiety* has to be present whereas in present claims 1 and 14, the solubility-promoting moiety has to be protected with the cyclic ketal acid labile moiety. Thus, claims 12, 13, 25 and 26 fail to further limit the subject matter of claims 1 and 14. Besides, in those claims 12, 13, 25 and 26, the solubility-promoting group (both the free solubility-promoting group or the protected solubility-promoting group) is not limited only to those as recited in present claims 1 and 14.

***Claim Rejections - 35 USC § 103***

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1, 2, 5, 7-16, 19, 21-27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sooriyakumaran et al (US 2002/0081520 A1) in view of Asakawa et al (5,863,699) and Bucchignano et al (6,037,097).

In his Example 3, Sooriyakumaran teaches partial protection of poly(2-hydroxy-3,3,3-trifluoropropylsilsesquioxane) with acid-cleavable trimethylsilyl group.

Sooriyakumaran also teaches using a photoacid generator as the second component of his resist composition (see [0056]). Sooriyakumaran does not teach present cyclic ketal acid-labile moiety.

Asakawa et al teaches the equivalence of the trimethylsilyl group (which is taught in Sooriyakumaran) and 1-methoxycyclohexyl group as acid-decomposable groups (see col.12, line 36 and 41). Therefore, in view of Asakawa's teaching of equivalency, it would have been obvious to one skilled in the art to use 1-methoxycyclohexyl group in

partially protecting poly(2-hydroxy-3,3,3-trifluoropropylsilsesquioxane) in Sooriyakumaran's Example 3. *Furthermore*, Bucchignano teaches (col.2, lines 21-29, lines 35-53 and col.4, lines 37-50) that by using a cyclic aliphatic ketal substituent such as a methoxycyclohexanyl group as an acid labile protecting group for an aqueous base soluble copolymer, one can obtain a chemically amplified resist that provides improved resist coating shelf life and with little or no vacuum effects on use and that prevents air-borne contaminants from adversely effecting the chemical nature of the aqueous base soluble copolymer. Bucchignano also teaches (col.4, lines 51-58) that hydrogen of the cycloaliphatic portions of the ketal substituent can be substituted with hydrophobic groups such as  $-\text{CF}_3$ ,  $-\text{CHF}_2$ ,  $-\text{CH}_2\text{F}$ ,  $-\text{CCl}_3$ ,  $-\text{CHCl}_2$ ,  $-\text{CH}_2\text{Cl}$ , and  $-\text{Si}(\text{CH}_3)_3$  in order to obtain additional etch resistance. In view of Asakawa, which shows that the trimethylsilyl group and methoxycyclohexyl group were art-recognized equivalent acid-decomposable groups, and further in view of Bucchignano's teaching that methoxycyclohexanyl group provides improved resist coating shelf life and little or no vacuum effects on use, it would have been obvious to one of ordinary skill in the art to use the methoxycyclohexanyl group (or methoxycyclohexanyl group substituted with  $\text{CF}_3$ ,  $-\text{CHF}_2$ ,  $-\text{CH}_2\text{F}$ ,  $-\text{CCl}_3$ ,  $-\text{CHCl}_2$ ,  $-\text{CH}_2\text{Cl}$ , or  $-\text{Si}(\text{CH}_3)_3$ ) as Sooriyakumaran's acid-cleavable group in his Example 3 *in order to obtain a chemically amplified resist that provides improved resist coating shelf life and with little or no vacuum effects on use and that prevents air-borne contaminants from adversely effecting the chemical nature of the aqueous base soluble copolymer*. Therefore, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present inventions of claims 1, 2, 5,

and 7-10 (i.e., those references teach present fluoroalcohol moiety (present pendant solubility promoting moiety) protected with present cyclic ketal acid-labile moiety):

**because present specification (pg.13, lines 19-32) also lists**

***“methoxycyclohexanyl” group as one of preferred examples for cyclic ketal***

**protecting groups that satisfy the first formula of claim 1**, it follows that the

methoxycyclohexanyl group, used as Sooriyakumaran's acid-cleavable group would inherently have a low activation energy less than about 20 kcal/mol for acid-catalyzed cleaving, and the same acid-cleavable group would inherently be cleavable at room temperature as presently recited.

Also, the poly(2-hydroxy-3,3,3-trifluoropropylsilsesquioxane) which is partially protected with methoxycyclohexanyl group as discussed above comprises present combination of monomeric units (II) and (III) in claims 12 and 25; *in the formula (III)*, X would be a methylene group,  $R^3$  would be a H atom,  $R^4$  would be  $-CF_3$  (a fluorinated alkyl group), q would be 0, and  $R^6$  would be  $-OH$  (a solubility promoting group). In the formula (II), X would be a methylene group,  $R^3$  would be a H atom,  $R^4$  would be  $-CF_3$  (a fluorinated alkyl group), q would be 0, and  $R^5$  would be methoxycyclohexanyl oxy group (present solubility inhibiting cyclic ketal group). Also, such polymer comprises present combination of monomeric units (II) and (V) in claims 13 and 26; *in the formula (V)*, X would be a methylene group, one  $R^3$  would be a H atom, another  $R^3$  would be  $-CF_3$  (a halogenated alkyl group), q would be 0, and  $R^6$  would be  $-OH$  (a solubility promoting group). Therefore, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present inventions of claims 12, 13, 25, and 26.

With respect to present claim 11, Sooriyakumaran teaches ([0055]) that his copolymer generally has an average Mw in the range of 1,000 to 5,000. Therefore, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present invention of claim 11.

Sooriyakumaran teaches ([0075]) a process for generating a resist image on a substrate which comprises the steps of: (a) coating a substrate with a film comprising his resist composition; (b) imagewise exposing the film to radiation; and (c) developing the image. Sooriyakumaran teaches ([0080]) that the pattern from the resist structure may then be transferred to the material of the underlying substrate by etching. Sooriyakumaran also teaches a post-exposure baking step (see [109]). Therefore, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present inventions of claims 14-16, 19, 21-24 and 30.

With respect to present claim 27, Sooriyakumaran teaches that a bilayer substrate may be employed in which his resist composition forms an upper resist layer on top of a bilayer substrate comprised of a base layer and underlayer that lies between the upper resist layer and the base layer. Thus, Sooriyakumaran in view of Asakawa and Bucchignano would render obvious present invention of claim 27.

5. Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sooriyakumaran et al (US 2002/0081520 A1) in view of Asakawa et al (5,863,699) and Bucchignano et al (6,037,097) as applied to claim 27 above, and further in view of Khojasteh et al (US 2002/0058204 A1).

Sooriyakumaran in view of Asakawa and Bucchignano is discussed above in Paragraph 4. As discussed above, Sooriyakumaran teaches that a bilayer substrate may be employed in which his resist composition forms an upper resist layer on top of a bilayer substrate comprised of a base layer and underlayer that lies between the upper resist layer and the base layer. Sooriyakumaran does not teach present underlayer composition of claim 28. Khojasteh teaches ([0009]-[0021]) an underlayer composition comprising (a) a polymer containing (i) cyclic ether moieties, (ii) saturated polycyclic moieties, and (iii) aromatic moieties, and (b) an acid generator, or an underlayer composition comprising (a) a polymer containing (i) saturated polycyclic moieties, and (ii) aromatic moieties, (b) an acid generator, and (c) a crosslinker. Khojasteh teaches that use of such an underlayer composition provide underlayers having outstanding optical, mechanical and etch selectivity properties ([0008]). In view of Khojasteh's teaching, it would have been obvious to one of ordinary skill in the art to use Khojasteh's underlayer composition for Sooriyakumaran's underlayer in order to obtain underlayer having outstanding optical, mechanical and etch selectivity properties as taught by Khojasteh. Khojasteh also teaches ([0058]) that the polymer of the underlayer composition preferably contains a fluorine components such as pentafluoroaryl group and trifluoromethyl group. Therefore, Sooriyakumaran in view of Asakawa and Bucchignano and further in view of Khojasteh would render obvious present inventions of claims 28 and 29.

***Response to Arguments***



6. Applicants argue that the solubility-promoting moiety such as fluoroalcohol as in present invention or as in Sooriyakumaran et al is even larger than the  $\alpha$ -trifluoromethyl alcohol group of Schmaljohann et al, thus suggesting that an even more powerful catalyst *may be* required for the protection reaction, which *could result* in undesired side products. However, applicants *have not* provided any evidence on the record that for larger fluoroalcohol, more powerful catalyst is required for the protection reaction. Schmaljohann does not state such correlation as suggested by applicants. In fact, Schmaljohann states that the reason why the PVA is protected readily with THP whereas the  $\alpha$ -trifluoromethyl alcohol groups is protected to only a small extent is *because the  $\alpha$ -trifluoromethylalcohol groups is acidic* (thus, more powerful *neutral* catalysts like ATPB give high conversion for the protection reaction); Schmaljohann is *not* saying that reason why the PVA is protected readily with THP whereas the  $\alpha$ -trifluoromethyl alcohol groups is protected to only a small extent is because the  *$\alpha$ -trifluoromethylalcohol group* is larger than PVA. Also, with respect to applicants' statement (based on Sinta) that although the use of a stronger catalyst may results in a successful protection reaction, undesired side products may render the photoresist unsuitable for its intended purpose, what Sinta means by "stronger catalysts" is catalysts which are stronger *in acidity*. However, what is used in Schmaljohann is ATPB which is a *neutral catalyst*. Therefore, applicants' argument is found to be unpersuasive, and thus present rejection over Sooriyakumaran in view of Asakawa and Bucchignano still stands.

Art Unit: 1752

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is 571-272-1333. The examiner can normally be reached on Monday-Friday from 9:00 am EST to 5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia Kelly, can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is **571-273-8300**.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*S. J. Lee*

S. Lee  
July 8, 2006

*Sin J. Lee*  
**SIN LEE**  
**PRIMARY EXAMINER**